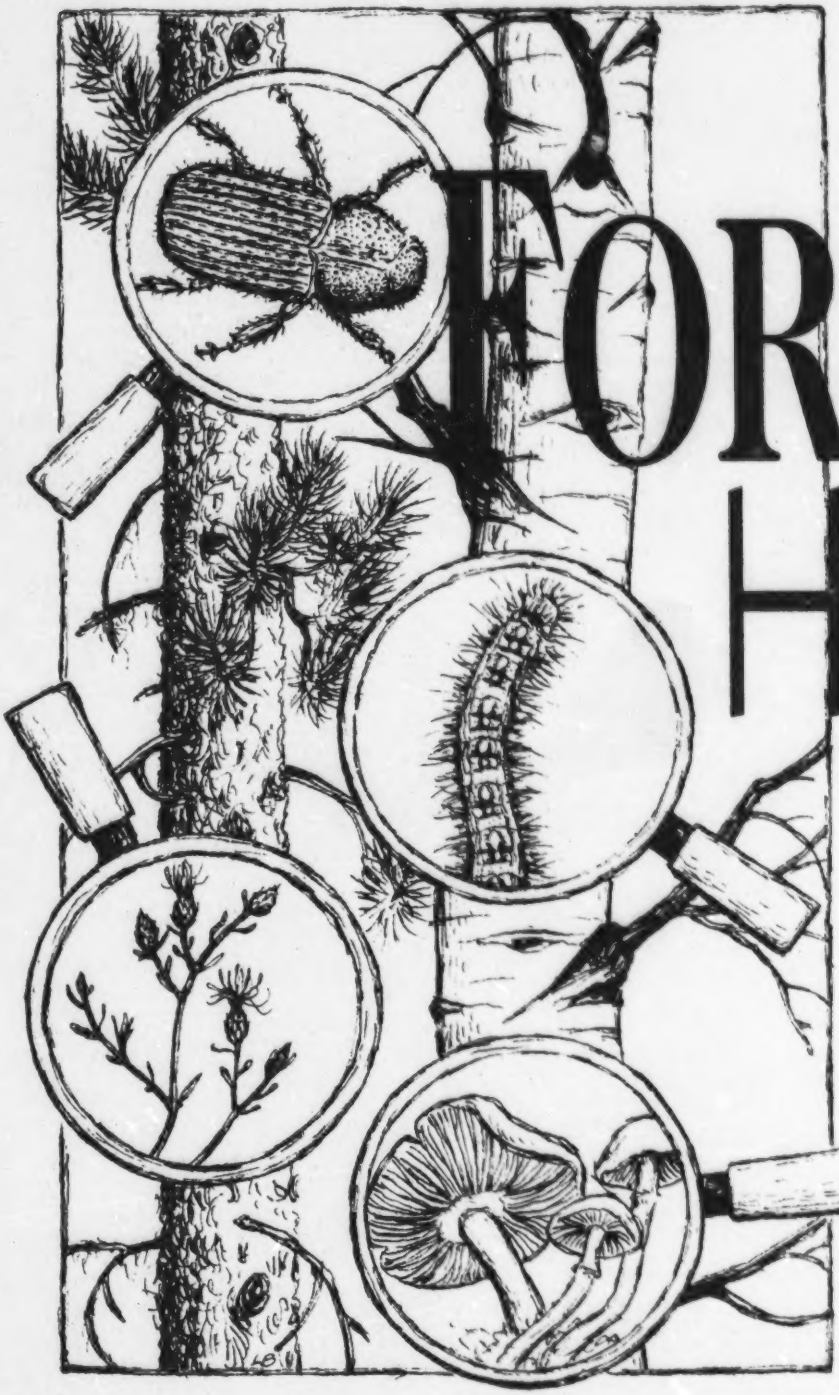
2001 ANNUAL REPORT



FOREST Health IN ALBERTA

LEGISLATURE LIBRARY
APR 10 2002
EDMONTON

102-05701/

2001
ANNUAL
REPORT

FOREST Health IN ALBERTA

Alberta
SUSTAINABLE RESOURCE
DEVELOPMENT

Copyright © Her Majesty the Queen in Right of Alberta, 2001

ISSN 1480-5685

This publication is available at no charge from:

Alberta Sustainable Resource Development
Land and Forest Division
Forest Management Branch
Forest Health Section
9th Floor, Great West Life Building
9920 – 108 Street
Edmonton, Alberta T5K 2M4

Visit the Forest Health Website at http://www3.gov.ab.ca/srd/forests/fmd/health/fh.html

Forest Health Vision

A healthy, sustainable forest landscape that fulfils the social, economic and environmental aspirations of all Albertans.

This report has been printed on Canadian recycled paper.

CONTENTS

FIGURES iii

TABLES iii

ACKNOWLEDGEMENTS v

SUMMARY vii

INTRODUCTION 1

INSECT AND DISEASE CONDITIONS IN 2001 AND PREDICTIONS FOR 2002 3

Conifer Pests 3
Spruce Budworm, *Choristoneura fumiferana* (Clemens) 3
Aerial Surveys on Defoliation 3
Northwest Boreal (NWB) Region 3
Northeast Boreal (NEB) Region 5
Northern East Slopes (NES) and Parkland Bow, Prairie (PBP) Regions 7
Forecast for 2002 Based on Pheromone Trap Catches in 2001 7
Parkland Bow, Prairie Region 7
Northern East Slopes Region 7
Northeast Boreal Region 9
Northwest Boreal Region 9
Forecast for 2002 Based on Second-Instar Larval Survey Results in 2001 10
Mountain Pine Beetle, *Dendroctonus ponderosae* Hopkins 14
Aerial and Ground Surveys 14
Survey with Pheromones 16
Pine False Webworm, *Acantholyda erythrocephala* (Linnaeus) 17
Deciduous Pests 18
Large Aspen Tortrix, *Choristoneura conflictana* (Walker) 18
Forest Tent Caterpillar, *Malacosoma disstria* Hübner 21
Bruce Spanworm, *Operophtera bruceata* (Hulst.) 21
Satin Moth, *Leucoma salicis* (Linnaeus) 21
Gypsy Moth, *Lymantria dispar* (Linnaeus) 22
Birch Leafminers, *Profenusa thomsoni* (Konow) and *Fenusa pusilla* (Lepeletier) 22
Smaller European Elm Bark Beetle, *Scolytus multistriatus* (Marsham) 22
Dutch Elm Disease (DED), *Ophiostoma ulmi* (Buis.) Nannf 22
Other Noteworthy Pests 24
Dothiorella Wilt of Elm, *Dothiorella ulmi* Verall & May 24
Ink Spot Disease of Aspen, *Ciborinia whetzelli* (Seaver) Seaver 24
Red Elm Weevil, *Magdalis armicollis* (Say) 24
Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Rohwer) 24
Root Collar Weevil, *Hylobius warreni* Wood 24
Disorders 24

INVASIVE EXOTIC PLANTS (WEEDS) 25

Provincial 25
Regional 25
Northern East Slopes Region 25
Education and Awareness 25
Control 26
Parkland Bow, Prairie Region 26
Control 26
Northwest Boreal Region 27
Inventory and Control 27
Northeast Boreal Region 27
Prioritizing Survey Areas 28
Invasive Exotic Plant Surveys 28

Co-operative Invasive Exotic Plant Management Groups 28

INCREASED AWARENESS AND TRAINING 29

PROVINCIAL 29
Increased Awareness 29
Posters and Pamphlets 29
Activity Book 29
North American Forest Insect Work Conference 29
Provincial Integrated Pest Management Group 30
Training 30
Invasive Exotic Plants 30
REGIONAL 30
Increased Awareness and Training 30
Parkland Bow, Prairie Region 30
Northwest Boreal Region 30
Northern East Slopes Region 30
Regional IPM Working Groups 31
Northeast Boreal Region 31
Northwest Boreal Region 31

RESEARCH AND DEVELOPMENT 33

FIELD TRIALS 33
Forest Tent Caterpillar Pheromone Study 33
Field Testing of Satin Moth Pheromone 33
Biological Control of Satin Moth 33
Monitoring Spread of Armillaria Root Disease 33
Estimating Stand Level Severity of Lodgepole Pine Dwarf Mistletoe 34
Biological Control of Scentless Chamomile 34
Impact of Ungulate Browsing 34
DEVELOPMENT 34
CD-ROM for Diagnosing Forest Pest Damage 34

REFERENCES 35

APPENDIXES 37

I. ALBERTA TOWNSHIP SYSTEM 37
II. INFORMATION ON OPERATIONAL USE OF PHEROMONES IN ALBERTA, 2001 38

FIGURES

1. Forest regions and forest areas in Alberta, 2001. 2
2. Spruce budworm-defoliated areas in 2001, compared to the budworm-defoliated areas in 2000 in the Northwest Boreal Region, Alberta. 4
3. Spruce budworm-defoliated areas in 2001, compared to the budworm-defoliated areas in 2000 in the Northeast Boreal Region, Alberta. 6
4. Predictions on the risk of spruce budworm outbreaks occurring in 2002, based on the moth catches in pheromone-baited traps in 2001, Alberta. 8
5. Predictions on spruce budworm defoliation severity in the Northwest Boreal Region in 2002, based on the second-instar larval counts in 2001. 12
6. Comparison of second-instar larval counts in sprayed vs. unsprayed plots in the Upper Hay Forest Area, Northwest Boreal Region in Alberta, 1999 – 2001. 13
7. Mountain pine beetle infestations and occurrence of beetle-hits in pheromone-baited plots in 2001, Alberta. 15
8. Large aspen tortrix-defoliated areas in 2001 in Alberta. 19

TABLES

1. The extent of spruce budworm-defoliated areas in 2001 vs. 2000 in Alberta 3
2. The results of the 2001 spruce budworm moth survey with pheromone-baited traps in the Northwest Boreal Region in Alberta 11
3. The results of 2001 vs. 2000 aspen pest defoliation surveys in Alberta 18

NOTE:

The mention of certain products does not necessarily imply their endorsements, nor does the exclusion of other products necessarily imply their disapproval by Alberta Sustainable Resource Development.

ACKNOWLEDGEMENTS

Sunil Ranasinghe, Forest Entomologist of Alberta Sustainable Resource Development, Land and Forest Division, compiled this report. It is based on the annual reports submitted by the Regional Forest Health Officers: Tom Hutchison (Northeast Boreal Region), Daniel Lux (Parkland Bow, Prairie Region), Mike Maximchuk (Northwest Boreal Region), and Erica Mueller (Northern East Slopes Region). Mike Undershultz, Forest Health Officer (Forest Health Centre) provided the details about the provincial invasive exotic plant (noxious and restricted weeds) program. Christine Kominek, Forest Health Officer, and Cody Crocker, Data Management Technologist (Forest Health Centre) finalized the forest health data and pest distribution maps presented in this document.

Janet Feddes-Calpas of Alberta Agriculture, Food and Rural Development, provided an update on Dutch elm disease. Christopher Saunders, an entomologist with the Community Services of the City of Edmonton, provided information on urban forest pests, which included the satin moth, birch leafminers and the pine false webworm.

Most of the field survey data reported here were collected, under the direction of the Regional Forest Health Officers, by forest protection technicians and summer crews working in the forest areas.

The industry support and participation in the 2001 Forest Health Program is gratefully acknowledged. These include supporting the forest pest survey programs, participating in invasive exotic plant program, responding to the forest health questionnaire, supporting the forest health training programs and attending the regional and provincial forest health meetings (IPM groups). Millar Western Industries Ltd., Buchanan Lumber Ltd., and Manning Diversified Forest Products supported the 2001 spruce budworm moth-trapping program. Tolko-High Level Lumber Division provided funding for the spruce budworm second-instar surveys in the Northwest Boreal Region. Alberta Energy Company actively supported the invasive exotic plant program in the Northeast Boreal Region.

SUMMARY

This annual report provides details about forest insect pests, diseases, and invasive exotic plants (noxious and restricted weeds) that occurred in Alberta in 2001. Reported here are the results of the aerial and ground surveys of pest infestations; invasive exotic plant management programs; training and increased awareness on forest health issues; and research and development carried out under the Forest Health Program of Alberta Sustainable Resource Development.

In 2001, the spruce budworm, *Choristoneura fumiferana* (Clem.) defoliated area in Alberta remained about the same as in 2000. An estimated 115 572 ha had moderate or severe spruce budworm defoliation, compared to the 116 481 ha defoliated in 2000. The results of predictive surveys carried out in 2001 forecast a lower risk of a two-year cycle budworm outbreak occurring in west-central Alberta in 2003. The risk of spruce budworm outbreaks occurring in 2002 is low in southern Alberta including Peter Lougheed Provincial Park. The forest areas currently affected by the spruce budworm outbreak in northwestern Alberta will continue to have a high risk of new outbreaks occurring in 2002. In these forest areas, severity of budworm defoliation in 2002 will remain about the same as in 2001. Most of the blocks sprayed with *Bacillus thuringiensis* var. *kurstaki* (Btk) in 1999 are expected to have some spruce budworm defoliation in 2002. The blocks sprayed with tebufinozide (Mimic®) in 1999 will still remain free of visible defoliation in 2002.

The mountain pine beetle, *Dendroctonus ponderosae* Hopkins, populations continued to increase in Banff National Park during 2001. In 2001, there were an estimated 1400 beetle-attacked trees within this park. In addition to the four beetle infestations found in the park in 2000, new infestations were detected at Tunnel Mountain and Fairholme Range. The beetle populations are estimated to rise 3- to 5-fold in 2002. The Department of Sustainable Resource Development (SRD) is concerned with this steady increase in the number of beetle-infested trees and the occurrence of new infestations close to the Green Area in the province. Ideally, the mountain pine beetle infestations have to be controlled during the current incipient stage of their population cycle. In collaboration with the other stakeholders including Banff National Park, SRD is working on a comprehensive, landscape-level plan to control the beetle infestations. The mountain pine beetle infestation in Jasper National Park is slowing down. Lesser number of "faders" and green-attack trees were found in this park in 2001, compared to 2000. The beetles appear to be on a two-year life cycle and their populations are not expected to build up in 2002. About 100 beetle-killed trees were found in Willmore Wilderness Park. The number of beetle-hits increased in 2001 in the pheromone-baited trees in Willmore Wilderness Park compared to 2000. Beetle-hits were also recorded in pheromone-baited trees in Cypress Hills Provincial Park where an endemic beetle population might be present.

The large aspen tortrix (LAT), *C. conflictana* (Walker), defoliated area in the province increased in 2001 to reach about 3.5 million ha. On the contrary, the Bruce spanworm, *Operophtera bruceata* (Hulst.), populations collapsed across the province. The forest tent caterpillar, *Malacosoma disstria* Hübner, defoliated area was indistinguishable from the predominant large aspen tortrix-defoliated area although overlapping populations of these two species were observed at some locations. The satin moth, *Leucoma salicis* (Linnaeus) populations in Edmonton collapsed possibly with the establishment of a parasitoid, *Cotesia melanoscelus*. No gypsy moths were trapped in 2001 under the SRD's gypsy moth monitoring program.

Introduced parasitoids were instrumental in controlling two birch leafminer species in the City of Edmonton.

The pine false webworm, *Acantholyda erythrocephala* (L.), populations in Edmonton declined below the level of detection.

Alberta still remains free of Dutch elm disease (DED). The Society to Prevent Dutch Elm Disease produced an educational kit to increase the DED awareness among the school children. There were many incidences of a vascular wilt disease, *Dothiorella ulmi*, affecting elm trees in the City of Edmonton. The smaller European elm bark beetle, one of the vector species of DED, continued to be trapped at many locations in the "White Area" of the province.

Ink spot disease caused by the pathogen *Ciborinia whetzelli* (Seaver) Seaver, defoliated some aspen stands in southern Alberta. The red elm weevil, Magdalis armicollis (Say), damaged some elm stands in southern Alberta.

Lightning- and flood-killed trees were observed during the overview aerial surveys of the Green Area.

In 2001, the provincial invasive exotic plant management program focussed on landscape level programs launched in co-operation with industry- and public-sector stakeholders. Forest area-based co-operative invasive exotic plant management groups were established under this initiative. The regional invasive exotic plant management programs included some inventory work, education and increased awareness, and control.

The Forest Health Centre (FHC) increased forest health awareness and provided training through posters, pamphlets and workshops. A poster to increase public awareness of the mountain pine beetle was published during 2001. This year, an activity book aimed at introducing the basic forest ecosystem concepts, forest values and forest health to children in grade 6 was published. The FHC of SRD co-operated with Northern Forestry Centre of the Canadian Forest Service and the University of Alberta to organize an international conference on forest insects held in Edmonton in May 2001. The FHC collaborated with several other governmental and non-governmental organizations to organize a workshop on invasive exotic plants. The Regional Forest Health Officers conducted many workshops and training sessions on forest health topics for the benefit of other SRD employees and industry participants.

The satin moth pheromone, Leucomalure, was field-tested in Edmonton and found to be effective in trapping male moths. A forest industry-funded field study indicated that *Cotesia melanoscelus* is more effective than *Meteorus versicolor* in controlling the satin moth. A procedure to estimate the dwarf mistletoe severity at the stand level was developed in 2001. This year, field trials were initiated to monitor the spread of Armillaria root disease in a selectively logged area and to monitor the effectiveness of two biological agents in controlling scentless chamomile. A long-term field trial was established to study the impact of browsing on seedlings to find the acceptability of browsed-seedlings in regeneration surveys.

INTRODUCTION

This is a report on forest insect and disease conditions in 2001 and the forecast on major forest pest conditions in 2002, in Alberta. Reported as well, are the details of invasive exotic plants (noxious and restricted weeds) that occurred in the forested area (Green Area) of the province. In addition, other forest health-related programs aimed at increasing awareness, training, technology transfer, and research and development are also described.

The Forest Health Program of Alberta Sustainable Resource Development is responsible for addressing forest health concerns within the Green Area of the province. This Green Area is administered by 17 forest areas (Note: Before 1999, the forest areas were known as forest districts) organized into four forest regions: Northwest Boreal (NWB) Region, Northeast Boreal (NEB) Region, Northern East Slopes (NES) Region and Parkland Bow, Prairie (PBP) Region (Figure 1).

Legal land descriptions based on Alberta Township System are used to describe any parcel of land in the province. Under this system, land is designated as being west of the 4th Meridian (longitude 110° west), 5th Meridian (longitude 114° west) or the 6th Meridian (longitude 118° west). Between these meridians are six-mile-wide columns called ranges, numbered consecutively from east to west. Townships are six-mile-wide rows that intersect the ranges. The townships are numbered consecutively from the southern border along Montana to the northern border along the Northwest Territories. The layout of these townships and ranges in Alberta is shown in Appendix I.

Given below are the highlights of forest health conditions in 2001 in Alberta. The large aspen tortrix, *Choristoneura conflictana* (Walker) was the predominant aspen defoliator in the province and the tortrix-defoliated area expanded further in 2001. The number of trees killed by the mountain pine beetle, *Dendroctonus ponderosae* Hopkins, in Banff National Park increased substantially and beetle-killed trees were observed closer to the park's border along the Green Area. The spruce budworm, *C. fumiferana* (Clemens), infestations in northern Alberta were unabated. Most of the satin moth, *Leucoma salicis* (Linnaeus), infestations around Edmonton collapsed possibly due to a larval parasitoid.

Figure 1. Forest regions and forest areas in Alberta, 2001.

INSECT AND DISEASE CONDITIONS IN 2001 AND PREDICTIONS FOR 2002

CONIFER PESTS

SPRUCE BUDWORM, *CHORISTONEURA FUMIFERANA* (CLEMENS)

Aerial Surveys on Defoliation

Aerial surveys were carried out in 2001 to estimate the defoliation severity and extent of spruce budworm-defoliated forest stands in Alberta. The procedure used for these surveys is described in the "Forest Health Aerial Survey Manual" (Ranasinghe and Kominek, 1999). The severity of spruce budworm defoliation was rated either as moderate (35% to 70% defoliation) or severe (over 70% defoliation) because it is difficult to observe light defoliation (i.e., less than 35% defoliation) from the air. The extent of the budworm-defoliated areas by severity categories is shown in Table 1.

Table 1. The extent of spruce budworm-defoliated area in 2001 vs. 2000 in Alberta

Region	Forest Area	Defoliated Area (ha)				Remarks
		2000		2001		
		Moderate	Severe	Moderate	Severe	
Northwest Boreal	Upper Hay	25 124	47 860	9236	56 788	Net area
	MacKenzie	337	9790	0	12 572	Net area
Regional Sub-total		25 461	57 650	9236	69 360	
Northeast Boreal	South of lat. 58° a	14 029	167	14 142	911	Net area
	North of lat. 58° b	3464	15 710	3321	18 602	Gross area
Regional Sub-total		17 493	15 877	17 463	19 513	
Grand total for Alberta		116 481		115 572		

[a] Athabasca Forest Area and part of Waterways Forest Area

[b] Includes part of Waterways Forest Area and part of Wood Buffalo National Park

Northwest Boreal (NWB) Region

A two-phased aerial survey was carried out in this region between July 9 and August 17, 2001. A fixed-wing aircraft (Cessna 210) was used for the general overview phase of this survey. A rotary wing aircraft (Robinson 44) fitted with a Trimble ProXR global positioning unit was used for the detailed aerial survey phase. The budworm-defoliated areas in the NWB Region are shown in Figure 2.

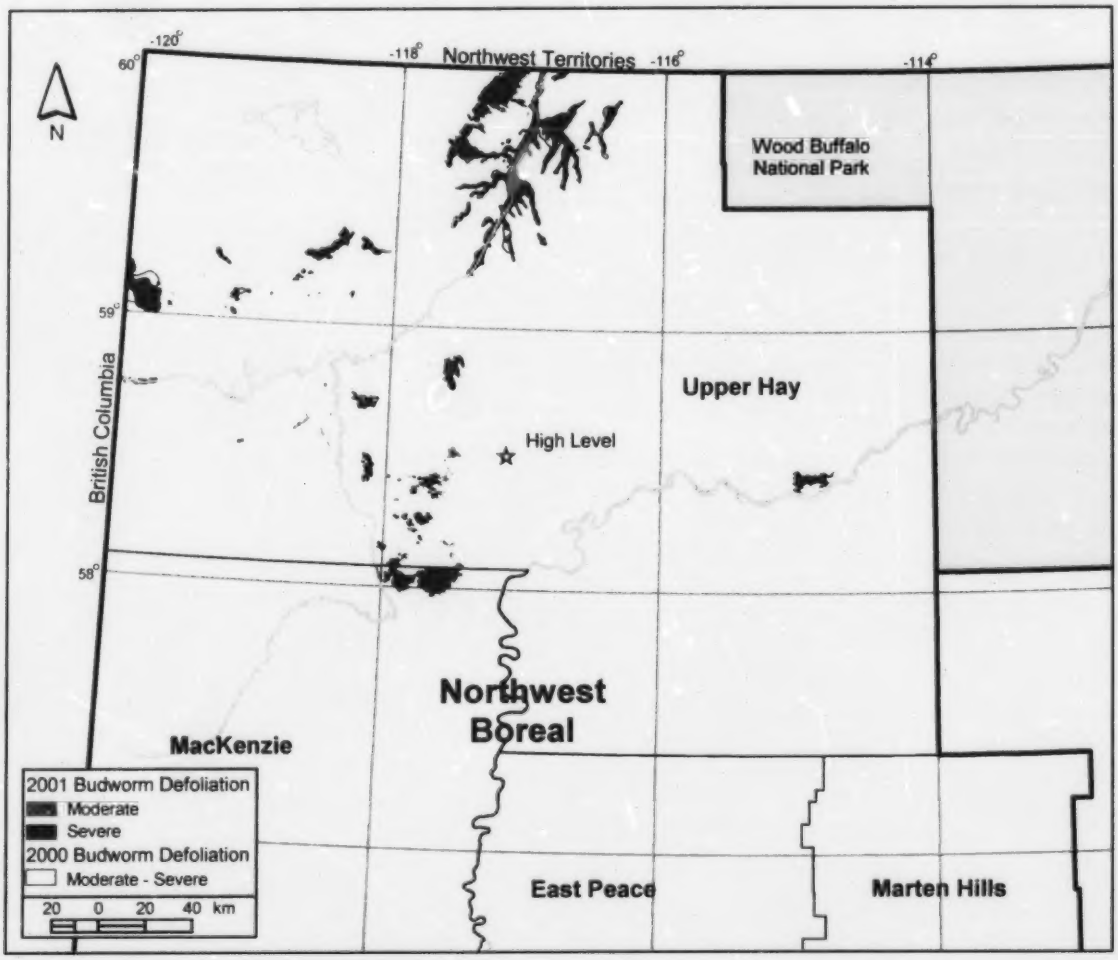


Figure 2. Spruce budworm-defoliated areas in 2001, compared to the budworm-defoliated areas in 2000 in the Northwest Boreal Region, Alberta[1].

[1] This year's spruce budworm-defoliated area estimates in the NWB Region were compiled by using Arc Info and updated digital inventories. Until last year, non-digital Phase III inventory maps were used to manually calculate these defoliated areas. The use of Arc Info made this year's defoliated area appear larger than the last year's on Figure 2 although in reality the area defoliated in 2001 was slightly smaller than the area defoliated in 2000.

In 2001, the spruce budworm defoliated an estimated 78 596 ha in the NWB Region. This is a slight decrease (5.4%) compared to the defoliated area observed in 2000. As forecasted in 2000, the severity of budworm defoliation within the NWB Region remained high in 2001. Altogether, the spruce budworm severely defoliated 69 360 ha of host stands in this region. This is 88% of the total defoliated area. In comparison, only 69% of the affected area was severely defoliated in 2000. Correspondingly, the moderately defoliated area decreased from 31% of the affected area observed in 2000 to 12% of the affected area in 2001.

In the Upper Hay Forest Area, the spruce budworm defoliated an estimated 66 024 ha in 2001 compared to 72 984 ha defoliated in 2000. This is a 10% drop in the defoliated area. However, severity of spruce budworm defoliation was high in this forest area. An estimated 56 788 ha (86%) of the affected area in 2001 were severely defoliated and 9236 ha (14%) were moderately defoliated. In comparison, only 66% of the affected area was severely defoliated and 34% of the affected area was moderately defoliated in 2000.

In the Upper Hay Forest Area, budworm defoliation was visible in 2001 in many areas sprayed with *Bacillus thuringiensis* var. *kurstaki* (Btk) in 1999 (Chinchaga River, East and West Sousa creeks, north of Paddle Prairie Metis Settlement); two other areas (Basset Lake, east of Chinchaga River) sprayed with Btk in 1999 were still without visible defoliation in 2001. However, all the areas sprayed with tebufinozide (Mimic®) in 1999 still remained free of visible defoliation in 2001. It appears that tebufinozide was better than Btk in providing longer-term protection from the spruce budworm.

In the Upper Hay Forest Area, either new or expanded spruce budworm defoliated-areas were found along the James and Jackpot creeks; Hay River; Steen River; northwest of Hutch Lake; near John D'or Prairie; and near Caribou Creek southwest of High Level.

In the MacKenzie Forest Area, the spruce budworm defoliated an estimated 12 572 ha compared to 10 127 ha defoliated in 2000. This is a 24% increase in the budworm-defoliated area compared to the area defoliated in 2000. All of this area was severely defoliated. Almost all of this defoliation (98.7%) was within the Paddle Prairie Metis Settlement.

Northeast Boreal (NEB) *Region*

An aerial overview survey was conducted from July 9 to 10, 2001, along the major river drainages to estimate the extent and severity of budworm defoliation in this region. A fixed-wing aircraft (Cessna 172) was used for this survey. The extent of 2001 regional spruce budworm defoliation by severity categories is shown in Table 1. The spruce budworm-defoliated areas in this region are shown in Figure 3.

The spruce budworm defoliated an estimated 15 053 ha south of latitude 58° N, i.e., an area for which non-digital Phase III forest inventory maps are available. This year's defoliated area shows a modest 6% increase compared to the 14 196 ha reportedly defoliated in the corresponding area in 2000. Severe budworm defoliation was observed on 911 ha (6% of the defoliated area) and moderate defoliation was observed on 14 142 ha (94% of the defoliated area) as shown in Table 1. Most (65%) of the budworm defoliation in areas south of latitude 58° N was in conifer-dominant forest stands. Along the Athabasca River, severe budworm defoliation was noted over 356 ha near Brule Rapids southwest of Fort McMurray; 340 ha north of Stoney Rapids; and 95 ha near Rapides du Joli Fou. Along the House River, severe budworm

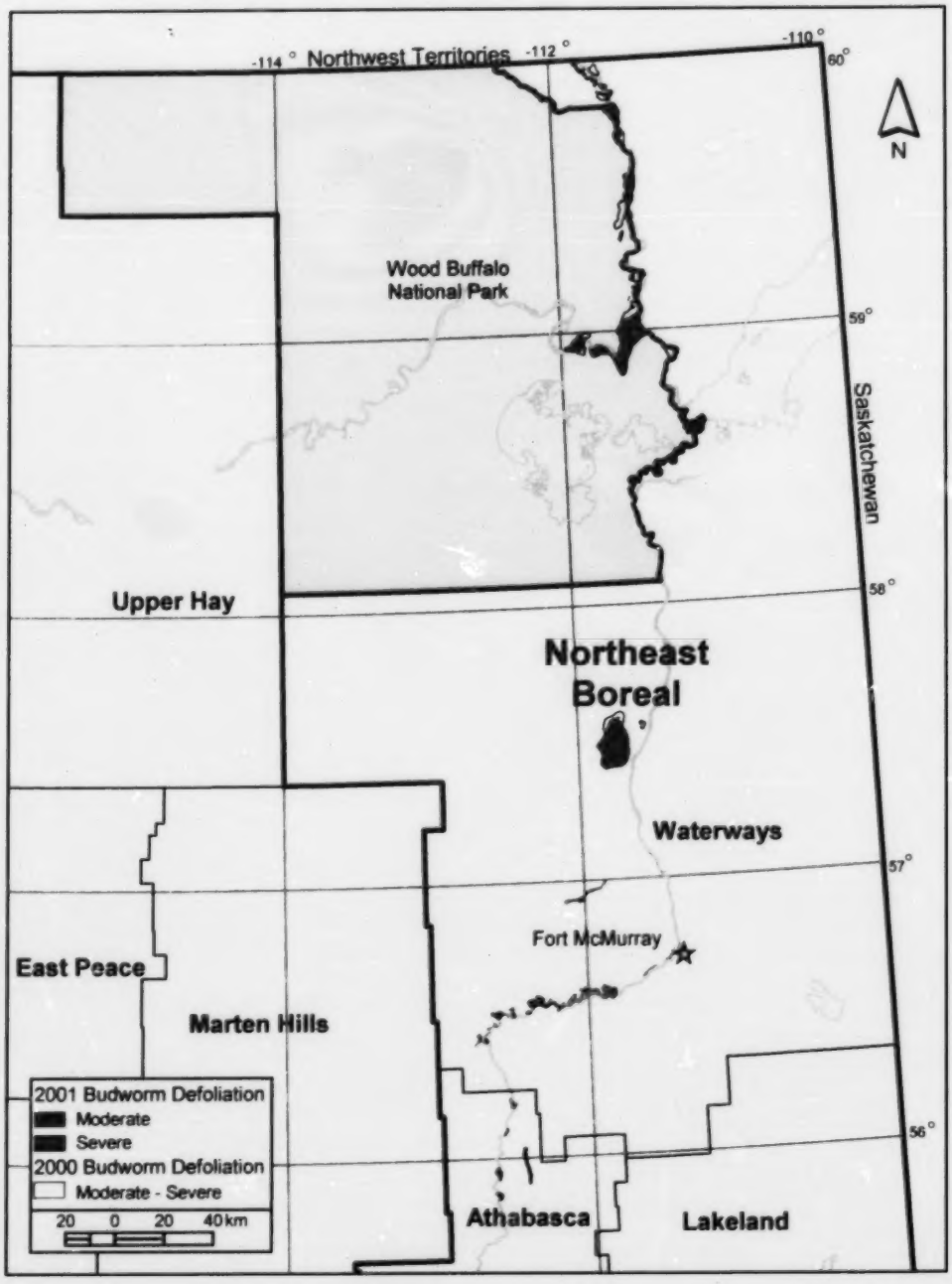


Figure 3. Spruce budworm-defoliated areas in 2001, compared to the budworm-defoliated areas in 2000 in the Northeast Boreal Region, Alberta.

defoliation was observed over 184 ha in Township 81 and Range 16. Moderate budworm defoliation was observed west of McClelland Lake (7267 ha); from Township 92, Range 12 to Township 91, Range 14 along the McKay River (1198 ha); scattered between Township 89, Range 10 to Township 85, Range 18 along the Athabasca River (4919 ha); near the confluence of the Athabasca and House rivers in Township 83, Range 16 and 17 (473 ha); and in Township 80, Range 16 (228 ha). In the NEB Forest Region, the spruce budworm defoliated an estimated 21 923 ha north of latitude 58° N (Table 1). These estimates are gross figures because no forest inventory maps are available for the areas north of latitude 58° N. Most of this defoliation was within Wood Buffalo National Park and on islands in the Slave River (Figure 3). About 85% of this defoliation was severe while the remainder was moderate. The largest patch of severe defoliation, an estimated 17 500 ha, was observed near the confluence of the Slave and Peace rivers. This is a 52% increase compared to the 11 500 ha defoliated by the budworm at this location in 2000.

Northern East Slopes (NES) and Parkland Bow, Prairie (PBP) Regions

There was no visible budworm defoliation reported in 2001 from these two regions.

Forecast for 2002 Based on Pheromone Trap Catches in 2001

The spruce budworm moth populations in several forest stands located across the Green Area were monitored to forecast the risk of spruce budworm outbreaks occurring in 2002. These stands were either budworm-defoliated or considered to be at high risk of being defoliated by the spruce budworm in the near future. Multi-Pher I® traps (Le Groupe Biocontrole, Quebec) baited with female sex pheromone lures (Biolure®, Consep Membranes Inc., USA) were used to monitor the spruce budworm male moth populations. The monitoring procedure is described in the "Spruce Budworm Management Guide" (Ranasinghe and Kominek, 1998).

One hundred and sixty-eight plots were established across the province to monitor the spruce budworm moths. The results of five of these plots were questionable and were excluded from further consideration. The forecast based on the results from the other 163 plots is shown in Figure 4.

Parkland Bow, Prairie Region

In the PBP Region, 12 plots were set up as follows in the forest areas of Bow (4); Brazeau (1); Clearwater (5); and Crowsnest (2). The trap catches in these 12 plots ranged from 6 to 154 moths per trap. These trap catches indicate a low risk of a budworm outbreak occurring in this region in 2002 (Figure 4). Last year a moderate risk of an outbreak was predicted for 2001 in Peter Lougheed Provincial Park in the Bow Forest Area. This year's moth catches indicate a low risk of a spruce budworm outbreak in this park in 2002.

Northern East Slopes Region

In the NES Region, 20 plots were set up as follows in the forest areas of Foothills (10); Woodlands (5); and Yellowhead (5). One plot in the Foothills Forest Area was inactive. The forecast based on the moth catches from the other 19 plots is shown in Figure 4.

Figure 4. Predictions on the risk of spruce budworm outbreaks occurring in 2002, based on the moth catches in pheromone-baited traps in 2001, Alberta.

In the Foothills Forest Area, as predicted in 2000, trap catches decreased in 2001. This area has the two-year cycle budworm, *Choristoneura biennis* Free., and the trap catches have been alternating between high and low numbers in consecutive years. In any given year, the trap catches of the two-year cycle budworm moths predict the risk of an outbreak occurring two years later. This year's low average trap catches in Willmore Wilderness Park in this forest area. (range: 4 to 184 moths per trap) indicate a low risk of an outbreak occurring in 2003. However, Willmore Wilderness Park has a moderate risk of an outbreak occurring in 2002 because relatively high trap catches were observed in 2000 in this park. In the Woodlands Forest Area, the average catches in the five plots ranged from 5 to 59 spruce budworm moths per trap. The risk of a spruce budworm outbreak occurring in 2002 is low in this forest area. The five plots in the Yellowhead Forest Area had catches varying from 2 to 124 moths per trap. The risk of a spruce budworm outbreak occurring in this forest area in 2002 is also low.

Northeast Boreal Region

In the NEB Region, 38 plots were established as follows in the forest areas of Athabasca (17); Lakeland (5); and Waterways (16). The forecast based on the trap catches in these plots is shown in Figure 4.

In the Athabasca Forest Area, the average trap catches indicated that the risk of outbreaks occurring in 2002 is low in eight plots (47%), moderate in another eight plots (47%) and high in one plot (6%). All the plots with low risk were located south of Township 77. These plots had catches ranging from 28 to 321 moths per trap. The eight plots with moderate outbreak risk (622 to 1913 moths per trap) and the plot with high outbreak risk (3752 moths per trap) were located north of Township 77 along the Athabasca and House rivers. This area, with a moderate to high risk of having new spruce budworm outbreaks, has to be monitored closely in 2002.

In the Lakeland Forest Area, pheromone trap catches indicated a low risk (80 to 118 moths per trap) of spruce budworm outbreaks in three plots (60%) and a moderate risk (669 moths per trap) of outbreaks in one plot (20%), in 2002. The remaining plot (20%) with a high risk of an outbreak occurring (2098 moths per trap) was located along the Christina River; this plot needs closer monitoring in 2002.

In the Waterways Forest Area, risk of an outbreak occurring in 2002 is high (2526 to 4629 moths per trap) in five plots (69%) and moderate (835 to 1841 moths per trap) in the other 11 plots (31%). One plot with a high outbreak risk was located on the western edge of the moderately defoliated area located west of McClelland Lake. However, no defoliation was associated in 2001 with the other high risk plots located on the west side of the Athabasca River north of Fort McMurray; north of the Muskeg River in Township 94, Range 11; and along the Clearwater River.

Overall, the risk of spruce budworm outbreaks occurring has been increasing in the Northeast Boreal Region during the last three years. This is particularly true in the Waterways Forest Area where most of the current spruce budworm outbreaks are found.

Northwest Boreal Region

In the NWB Region, 98 plots were established as follows in the forest areas of East Peace (7); Lakeshore (8); MacKenzie (21); Marten Hills (4); Smoky River (6); Upper Hay (47); and Wapiti

River (5). Four of these plots were inactive and were dropped from consideration. The results of the remaining 94 plots of this survey are summarized in Table 2. The forecast based on these results is shown in Figure 4.

The risk of a budworm outbreak occurring in 2002 is low in the forest areas of Lakeshore (8 to 61 moths per trap) and Wapiti River (0–360 moths per trap). Historically, there has been a low risk of spruce budworm outbreaks occurring in these forest areas.

The risk of spruce budworm outbreaks occurring in 2002 is low to moderate in the forest areas of East Peace, MacKenzie, Marten Hills, and Smoky River. In these forest areas, the percent of plots with moth catches indicating a moderate risk of an outbreak varied from 14% in the East Peace to 33% in the Smoky River. The MacKenzie Forest Area with 3 out of 20 plots (15%) in the moderate risk category is most likely to be at risk of new spruce budworm outbreaks occurring in 2002. This forest area has a history of recent spruce budworm outbreaks and plots with relatively higher numbers of moths per trap (Table 2).

Nine plots (21%) in the Upper Hay Forest Area had trap catches predicting a high risk of outbreaks in 2002. Five of these plots were located in areas west and southwest of High Level. Most of these areas have had spruce budworm defoliation in the past making them susceptible for attack again. These areas need to be closely monitored in 2002. Similarly, one plot with a high risk of spruce budworm outbreak was located near John D'or Prairie with a history of recent budworm outbreaks. This as well as the high-risk plots located on the fringe of Cameron Hills and Dizzy Creek indicate potential new outbreak areas in 2002. In this forest area 68% of the plots had a moderate risk and another 11% of the plots had a low risk of spruce budworm outbreaks occurring in 2002 (Table 2). Overall, there is a relatively greater risk of spruce budworm outbreaks occurring in 2002 in this forest area.

Forecast for 2002 Based on Second-Instar Larval Survey Results in 2001

Second-instar (L_2) larval surveys were carried out in the Northwest Boreal Region in forest stands that have been defoliated by the budworm during the current outbreak and in their vicinities. The results of these surveys were used to forecast the severity of defoliation expected in 2002 in the currently infested areas. The survey procedures are described in the "Spruce Budworm Management Guide" (Ranasinghe and Kominek, 1998).

In the NWB Region, 136 L_2 plots were established. All the plots were located in unsprayed stands because there was no aerial spraying in 2001 to control the spruce budworm in Alberta. The results of this survey are shown in Figure 5.

In the MacKenzie Forest Area, 4 out of 5 plots had larval counts that forecast severe defoliation in 2002. Three of these plots were located in the Paddle Prairie Metis Settlement. This was expected because the affected area in the Metis Settlement was not sprayed during the last three years, in spite of a severe spruce budworm outbreak. In 2002, severity of budworm defoliation is expected to remain high in the northwestern area of the Paddle Prairie Metis Settlement. Some tree kill was evident during the aerial overview surveys of this settlement, but the cause of tree kill is yet to be verified by ground-truthing. If severe defoliation continues in the Metis Settlement, there may be more tree kill there within the next few years. Consequently, the infestation may collapse due to lack of food supply for the budworms. One plot with high

Table 2. The results of the 2001 spruce budworm moth survey with pheromone-baited traps in the Northwest Boreal Region of Alberta

		FOREST AREA						
Risk Category		**East Peace**	**Lake-Shore**	**Mac-Kenzie**	**Marten Hills**	**Smoky River**	**Upper Hay**	**Wapiti River**
NIL - LOW	**No. of plots per category**	6	8	17	3	4	5	5
	Percent of plots per category	86%	100%	85%	75%	67%	11%	100%
	Min/Max count in plots	46/323	8/61	6/345	30/126	12/254	241/ 463	0/360
MODERATE	**No. of plots per category**	1	0	3	1	2	30	0
	Percent of plots per category	14%	0%	15%	25%	33%	68%	0%
	Min/Max count in plots	562	--------	526/ 1768	847	653/ 787	514/ 1976	--------
HIGH	**No. of plots per category**	0	0	0	0	0	9	0
	Percent of plots per category	0%	0%	0%	0%	0%	21%	0%
	Min/Max count in plots	--------	--------	--------	--------	--------	2016/ 4252	--------

budworm counts and another plot with moderate budworm counts were located in the Hawk Hills area where a perennial budworm infestation collapsed in 1999. This area has been free of defoliation during the last two years. However, based on the survey results, moderate to severe budworm defoliation could be expected in Hawk Hills plots in 2002.

In the Upper Hay Forest Area, 131 plots were established. The larval counts predicted severe defoliation in 40 plots (31%); moderate defoliation in 28 plots (21%); and light defoliation in 63 plots (48%), in 2002. Thus, either moderate or severe defoliation is expected in 52% of the forest area plots in 2002. In comparison, 56% of the plots were expected to have moderate or severe defoliation in 2001. This shows that in this forest area, the severity of defoliation in 2002 may remain about the same as in 2001. In the Upper Hay Forest Area, severe spruce budworm defoliation is expected in 2002 in the following areas: Cameron Hills west of Indian Cabins;

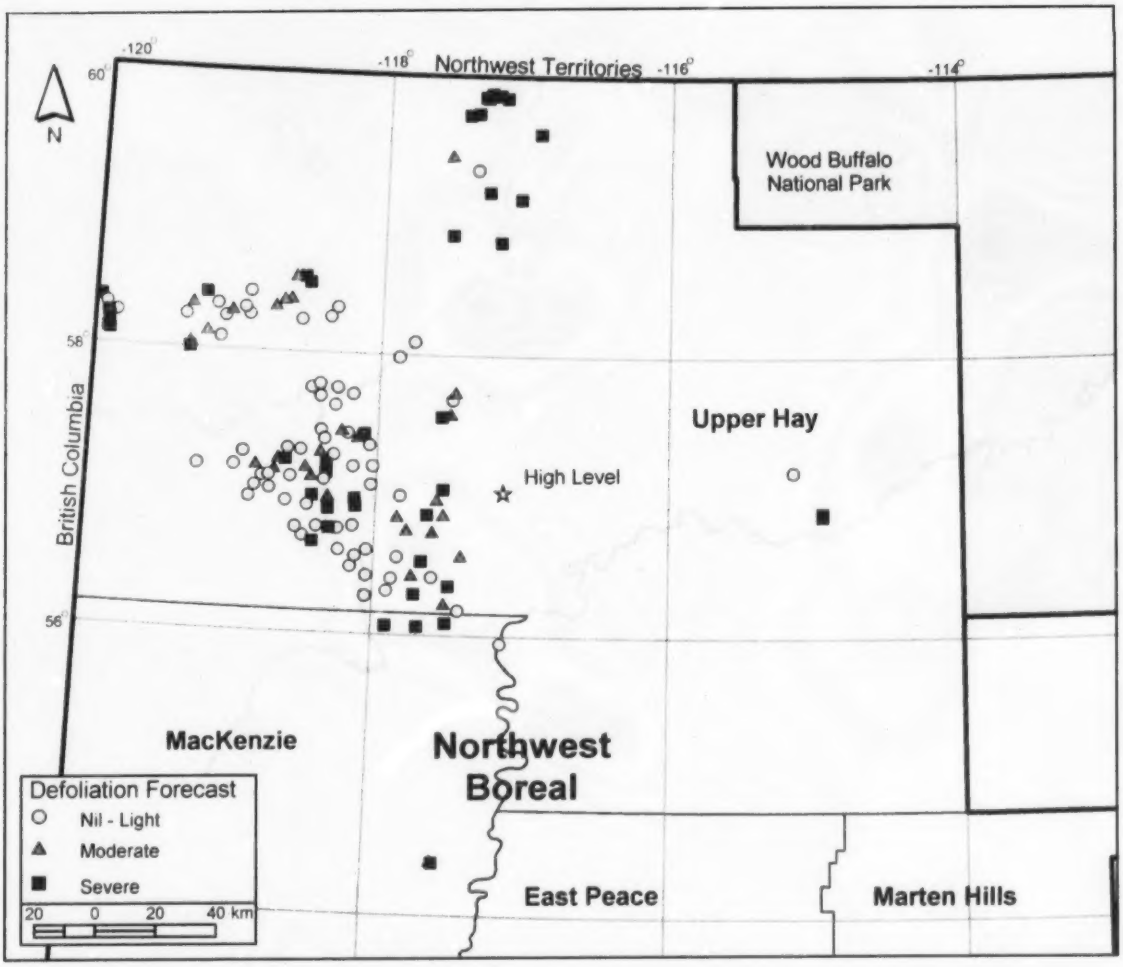


Figure 5. Predictions on spruce budworm defoliation severity in the Northwest Boreal Region in 2002, based on the second-instar larval counts in 2001.

Townships 115 to 117 along the South Shekelie River; stretches along the Little Rapids Creek; Dizzy Creek; Steen River; Hay River; James Creek; Yates River; Lessard Creek; Jackpot Creek; and in Township 109 south of Highway 58. In this forest area, moderate or severe defoliation is expected in 2002 in areas west and north of Zama City; in Townships 115 to 117 along the Vardie River; Townships 108 to 111 along the Chinchaga River; along the East and West Sousa creeks; north of the Paddle Prairie Metis Settlement; Townships 108 to 109 southwest of High Level; and southeast of John D'or Prairie. Moderate budworm defoliation can be expected in 2002 in areas north of the Paddle Prairie Metis Settlement; north of Zama City; along the Negus Creek; and northwest of Hutch Lake.

In 1999, the high second-instar larval counts predicted to cause severe defoliation prompted spraying of some blocks with either Btk or Mimic to control the budworm. The larval counts in the plots located in the Btk-sprayed blocks were reduced to acceptable low levels in 1999 but have since been increasing. These plots had an average larvae per 10 m^2 of foliage of 131.80 following Btk spraying in 1999, 170.77 in 2000 and 375.08 in 2001. In comparison, the larvae per 10 m^2 of foliage in Mimic-sprayed plots were 22.30 in 1999, 150.39 in 2000 and 94.51 in 2001. These numbers support the possibility of longer-term spruce budworm protection being provided by Mimic, compared to Btk. In comparison, the average second-instar larvae per 10 m^2 of foliage in the unsprayed plots, i.e., located in blocks expected to have nil-light defoliation in 1999, were 422.23 in 1999, 534.67 in 2000 and 379.96 in 2001 (Figure 6).

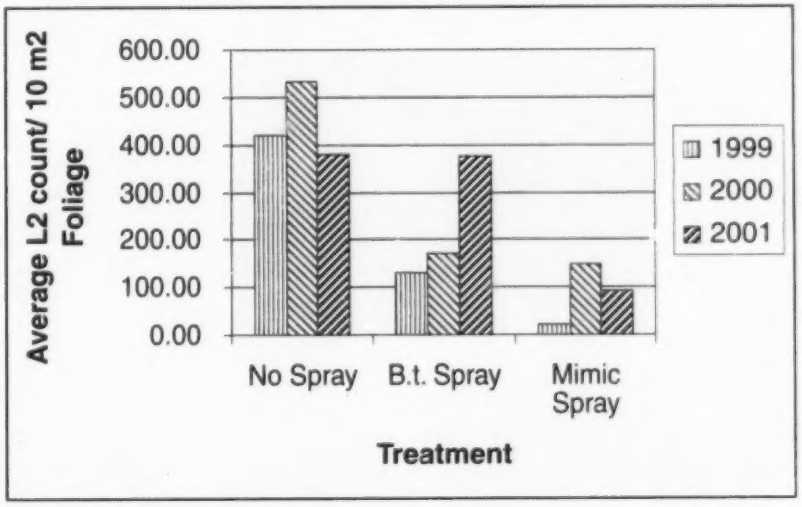


Figure 6. Comparison of second-instar larval counts in sprayed vs. unsprayed plots in the Upper Hay Forest Area, Northwest Boreal Region in Alberta, 1999 – 2001.

MOUNTAIN PINE BEETLE, *DENDROCTONUS PONDEROSAE* HOPKINS

Aerial and Ground Surveys

In the fall, the Green Area in southwestern Alberta was aerially surveyed to detect mountain pine beetle (MPB) infestations. The Regional Forest Health Officers in the NES and PBP regions used rotary-wing aircraft to conduct these surveys. The surveys mainly covered river valleys in the foothills bordering B.C. to the west and the U.S. border to the south.

In the PBP Region, trees symptomatic of previous year's MPB infestations, i.e., trees with red crowns, were not detected during this year's aerial surveys. In Waterton National Park, no signs of beetle activity were visible from the air.

In Banff National Park, the MPB activity increased considerably in 2001 (Figure 7). Leo Unger (Canadian Forest Service, Pacific Forestry Centre) carried out aerial and ground surveys in June and in September over the infested areas of Banff National Park. His preliminary findings showed an estimated 600 MPB-killed trees altogether at Mount Norquay, Stoney Squaw, Healy Creek and Brewster Creek, i.e., four sites that were previously infested. Altogether, an estimated 1427 green-attack trees, i.e., trees with current year attacks, were found during the ground surveys of Tunnel Mountain, Fairholme Range, Mount Norquay and Stoney Squaw sites. At Mount Norquay there were three "faders" and 19 green-attack trees in 2000. A ground survey at this site confirmed 19 faders and 701 green-attack trees in 2001. The number of MPB-attacked trees has been rising steadily at the Stoney Squaw Mountain site during the last three years; this site had 2 to 3 "faders" in 1999; these increased to 15 to 20 "faders" in 2000. As well, about 150 green-attack trees were counted during a ground survey of this site in 2000. The MPB populations at Stoney Squaw Mountain increased many-fold during 2001. This site with dry south exposure and large, overmature pines is an optimum MPB site. This is also a source of large MPB broods that are dispersing to the other sites due to limited availability of suitable host trees at this site. There were about 10 MPB infestations in 2000 scattered along the Healy Creek. These showed various rates of population increases due to differences in slope, aspect, steepness and other site-related factors. In 2000, there were an estimated 500 green-attack trees along the creek, with the largest concentration on steep southerly aspect slopes below Sunshine Road. In 2001, the estimated number of MPB-infested trees at this site was lowered to 200. Most of these attacked-trees are of smaller diameter, which will result in smaller broods. The infested site at Brewster Creek expanded quickly in response to the warmer weather in 1998, but appeared to have slowed down since then. At this site there were about 25 green-attack trees in 2000 but the MPB appeared to be on a two-year cycle. This site has the least potential for expansion and had several partial attacks only in 2001 (Ian Pengelley, Banff National Park, personal communication).

Several new MPB infestations were detected in Banff National Park during aerial surveys carried out in 2001. The aerial observers estimated 176 MPB-killed trees along the Bow Valley between Banff town site and the park's southern border at Harvie Heights. Subsequent ground observers detected 726 green-attack trees at the Tunnel Mountain campsite in Banff townsite and on the southwest aspects of the Fairholme Range (Figure 7). This is causing concern because of the close proximity of some attack sites to the forested Crown land in Alberta. The ground surveys at this site indicated good brood survival but limited amount of frass with no pitch tubes. The MPB populations at these sites are expected to increase 3- to 5-fold in 2002.

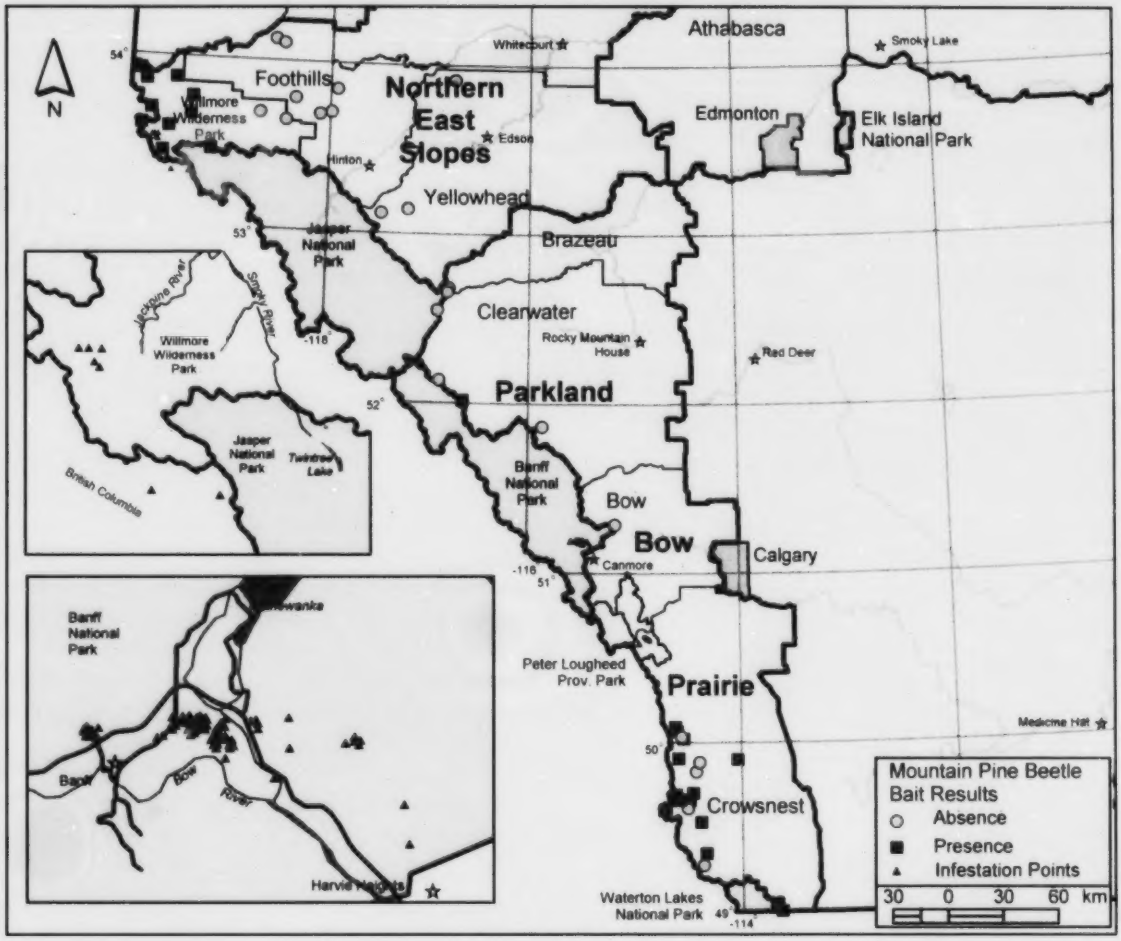


Figure 7. Mountain pine beetle infestations and occurrence of beetle-hits in pheromone-baited plots in 2001, Alberta.

The Department of Sustainable Resource Development (SRD) is very concerned that the current MPB population in Banff National Park appears to be entering into an epidemic phase. Once the MPB populations are at an epidemic phase, it is difficult to suppress them (Safranyik, 2000). Ideally, MPB populations should be controlled at the incipient phase, i.e., before they enter the epidemic phase. In association with the other stakeholders including forest industry, Department of Community Development and Banff National Park, SRD is working on short- and long-term plans to control the MPB. This is one of the objectives of a broader plan that envisages improving wildlife habitat and wildfire control in these areas as well. The short-term plan of cutting and burning MPB-infested trees will limit the beetle spread. The long term objective is to reduce the number of high MPB-hazardous forest stands along the common border between the parks and the managed forest by means of a landscape management plan.

In Jasper National Park, MPB was located for the first time in 1999 during an aerial overview survey when several attack sites were detected along the Smoky River near Bess Pass. The number of faders declined in 2001 to 12 trees at six sites, compared to 70 trees at 23 sites in 2000. Most of recent tree kill was in the Chown Creek area but scattered beetle-killed trees were found as far south as the confluence with the Carcajou Creek. The process of tree discolouration in this park appears to be prolonged and may not necessarily be comparable from year to year. In 2001, altogether 26 green-attack trees were detected in the park during a ground survey. Most of these attacks appear to have been initiated, without eggs being laid, in 1999; eggs were laid in 2000 and the larval mortality was fairly high. Only 14 trees attacked in 2001 were found during this ground survey. These trees were scattered between Smokey Cabin and the Carcajou Creek (Unger, 2001). These attacked-trees appeared to be heavily hit but the galleries were relatively shorter with about 50% larval survival. In Jasper National Park, MPB is not considered to be a problem. The MPB attacks normally occurred simultaneously with lodgepole pine beetle, *D. murryanae* Hopkins, or turpentine beetle, *D. valens* LeConte, attacks. Most of the MPB are supposed to be on a two-year cycle and their populations are not likely to build up in 2002. (Alan Westhaver, personal communication).

In the NES Region, no MPB-killed trees were observed during an aerial overview survey of the Green Area. However, about 100 trees with red crowns possibly symptomatic of MPB attacks were found in Willmore Wilderness Park. These were observed in the Meadowland Valley in an area near the Jackpine River and west of Ptarmigan Lake. A preliminary ground survey in the Meadowland Valley confirmed the presence of MPB-attacked trees (Figure 7).

Survey with Pheromones

In southwestern Alberta, lodegpole pine stands with a high risk of becoming infested with MPB were monitored for beetle activity. A two-component aggregation pheromone bait (Phero Tech Inc., B.C.) was used for this survey. Forty-eight plots were established to monitor MPB activity in southern Alberta in 2001. The procedure for deploying these pheromone baits is described in "Mountain Pine Beetle Management Guide 1999" (Kominek, 1999). The results of this survey are summarized in Figure 7.

In the PBP Region, 27 MPB-monitoring plots were established as follows in the forest areas of Bow (1); Brazeau (2); Clearwater (4); and Crowsnest (20). There were no beetle-hits in 2001 in the single plot located in the Bow Forest Area. In comparison, 70% of the 10 plots in the Bow Forest Area had MPB attacks in 2000. This year only one plot was set up in the Bow Forest Area because of its close proximity to current MPB infestations in Banff National Park. In spite

of these results this forest area may have MPB infestations in 2001 because of the current MPB infestations in adjoining Banff National Park. There were no beetle-hits in the two plots located in the Brazeau Forest Area. In the Crowsnest Forest Area, the percent of plots with beetle attacks increased from 55% in 2000 to 75% in 2001; similarly, in the Clearwater Forest Area, the number of plots with beetle attacks increased from 0% in 2000 to 25% in 2001. The number of beetle-hits per tree was 15 in the Clearwater Forest Area and varied from 1 to 43 in the Crowsnest Forest Area. The beetles in these trees were mechanically removed. In the Clearwater and Crowsnest forest areas, the incidence of MPB increased in 2001 compared to 2000. However, these results do not indicate an imminent MPB attack in 2002 in the Clearwater and Crowsnest forest areas.

In the NES Region, a ground survey carried out in the spring of 2001 showed almost no MPB survival in the pheromone-baited trees attacked in 2000 in Willmore Wilderness Park. Accordingly, no MPB control measures were implemented in these plots in the spring of 2001. However, there were beetle-hits in 10 out of 18 plots (56%) set up in the Foothills Forest Area in 2001. All the plots with beetle-hits were located in Willmore Wilderness Park. The number of beetle hits per tree in these plots increased (range: 1–300) in 2001 compared to that in 2000. In addition, two non-baited trees had 53 and 93 beetle-hits respectively. These observations suggest the need to be vigilant against possible MPB infestations in this park in 2002. There were no beetle-hits in 2001 either in the three plots located in the Weldwood Forest Management Area or in the three plots located in the Yellowhead Forest Area.

In Cypress Hills Provincial Park, MPB attacked baited-trees at 34 out of 54 plots. Altogether 153 beetle-hits were recorded at these 34 plots. This incidence of MPB is a concern because these results suggest the possible existence of an endemic beetle population within the park.

PINE FALSE WEBWORM, *ACANTHOLYDA ERYTHROCEPHALA* (LINNAEUS)

In Alberta, the pine false webworm is an urban pest of ornamental lodgepole pine plantings in Edmonton. This year, the declining pine false webworm populations at the monitoring site located in Edmonton fell below detectable levels. However, evidence of webworm activity was visible in other areas within the city. In Edmonton, there was no need to control this pest because of the low population levels in 2001.

DECIDUOUS PESTS

The extent of aspen defoliation by insect pests is estimated during aerial surveys carried out in the summer. The survey procedures are described in the "Forest Health Aerial Survey Manual" (Ranasinghe and Kominek, 1999). The observers categorize aspen defoliation severity as light (<35% defoliation); moderate (35 – 70% defoliation) or severe (>70% defoliation). Table 3 and Figure 8 show the results of these surveys.

Table 3. The results of 2001 vs. 2000 aspen pest defoliation surveys in Alberta

REGION [a]		GROSS AREA OF ASPEN DEFOLIATED BY INSECTS (ha)[b]					
		2000			2001		
		Light	Moderate	Severe	Light	Moderate	Severe
	Pest						
North-west Boreal	BSW	0	4306	334	0	0	0
	FTC	2979	42 647	303 601	0[c]	0[c]	0[c]
	LAT	34 889	337 058	1 814 459	141 994	3 044 776	5742
Sub-total		2 540 273			3 192 512		
Northern East Slopes	BSW	0	0	0	0	0	0
	FTC	400	0	0	0[c]	0[c]	0[c]
	LAT	0	18 757	89 902	0	158 653	56 636
Sub-total		109 059			215 289		
Parkland, Bow, Prairie	BSW	264	0	1421	0	0	0
	FTC	349	2031	14 113	0[c]	0[c]	0[c]
	LAT	0	0	0	7207	16 510	85 789
Sub-total		18 178			109 506		
Alberta Total		2 667 510			3 517 307		

[a] No aspen pest defoliation was detected in 2001 during aerial overview surveys in the Northeast Boreal Region.

[b] Gross area, i.e., total area covered by the polygon rather than the actual extent of the aspen stands.

[c] In 2001, some forest tent caterpillar defoliation was found mixed with large aspen tortrix damage; this damage was, however, indistinguishable from the predominant large aspen tortrix defoliation found in the same area.

BSW = Bruce spanworm; FTC = Forest tent caterpillar; LAT = Large aspen tortrix

The overall area of aspen defoliated by insects increased in 2001. This year, the large aspen tortrix was the predominant aspen defoliator in the province (Figure 8).

LARGE ASPEN TORTRIX, *CHORISTONEURA CONFLICTANA* (WALKER)

In Alberta, the large aspen tortrix (LAT) is primarily a defoliator of aspen. The LAT outbreaks usually last 2 to 3 years. These outbreaks end soon after with the onset of contemporaneous forest tent caterpillar populations that reach outbreak proportions (Ives and Wong, 1988). The

Figure 8. Large aspen tortrix-defoliated areas in 2001 in Alberta.

LAT has been defoliating aspen stands in Alberta during the last three years. In 2001, the large aspen tortrix-defoliated area in central and northwestern Alberta increased dramatically but severity of defoliation was lesser than in 2000 (Figure 8). The LAT outbreaks are expected to decline in the near future.

In the NWB Region, the large aspen tortrix-defoliated area reached an estimated 3 192 512 ha in 2001, an increase of 46% compared to the area defoliated by this pest in 2000. This is the "gross" defoliated area, i.e., total area of polygons rather than the area of individual stands affected. Defoliation was severe over 5742 ha (0.18%), moderate over 3 044 776 ha (95.37%) and light over 141 994 ha (4.45%). In comparison, defoliation was severe over 83%, moderate over 15.4% and light over 1.6% of the affected area in 2000. Thus, the large aspen tortrix defoliation was less severe this year, compared to 2000. As well, the tortrix-defoliated area shifted further eastwards compared to the area defoliated in 2000. The large aspen tortrix defoliated stands within the Forest Management Agreement (FMA) areas of Canadian Forest Products Ltd. (Hines Creek); Daishowa Marubini International (DMI); Tolko (High Prairie); Slave Lake Pulp Corporation; Footner Forest Products Ltd.; and Weyerhaeuser (Grande Prairie) Ltd. Specifically, defoliation was observed at Sturgeon Lake; near Snuff Mountain Fire Lookout; south of Grande Prairie; Saddle Hills; Birch Hills; Clear Hills; Whitemud Hills; along the Peace River west of Fairview; in Rainbow Lake; Zama City; Cameron Hills; Meander River; High Level; Fort Vermillion; around Talbot Fire Lookout; Hawk Hills; Cadotte Lake; southeast of High Prairie; and near Hotchkiss Fire Lookout.

A large area of aspen defoliation was reported north of Wabasca within the Townships 85-88 and Ranges 24-25 in the Marten Hills Forest Area. However, these areas could not be surveyed because this infestation was reported well after the other surveys were carried out.

In the NES Region, large aspen tortrix-defoliated area nearly doubled to reach 215 289 ha compared to 109 059 ha defoliated in 2000 (Figure 8). However, the severity of defoliation was less in 2001 with 56 636 ha (26%) severely defoliated and the remainder of 158 653 ha (74%) moderately defoliated. This is a reversal of the defoliation severity observed in 2000 when 83% of the affected area was severely defoliated and 17% was moderately defoliated. There was no aspen defoliator damage in the Foothills Forest Area. In the Woodlands Forest Area, the large aspen tortrix defoliation expanded in 2001. New defoliated areas were observed from Township 49 Range 15 to Township 51 Range 18; Township 50 Range 12 to Township 51 Range 9; and Township 53 Range 11 to Township 52 Range 10. In the Yellowhead Forest Area, the large aspen tortrix affected areas were mostly within Township 43 Range 7 to Township 45 Range 6 and Township 45 Range 8 to Township 46 Range 8; in addition, numerous scattered patches of defoliation were found elsewhere within this forest area (Figure 8).

In the NES Region, the copious amount of silk produced by the large aspen tortrix larvae caused concerns to the private homeowners. Due to their large numbers these larvae were seen feeding even on spruce, an unusual host species, in the Whitecourt and Fox Creek areas. The large aspen tortrix moths caused public nuisance in Edson, Hinton and Jasper when millions of moths migrated through these areas. These moths laid eggs on any available substrate including cars, buildings, rocks and handrails. The emergency ward in Jasper Hospital was closed as moths piled up on the floors and clogged the vents.

In the PBP Region, several patches of large aspen tortrix defoliation were observed in the Bow and Crowsnest forest areas during the 2001 aerial surveys. In the Bow Forest Area, these

patches were scattered within the Townships of 21 to 25 and Ranges 3 to 6. In the Crowsnest Forest Area, defoliation was found within the Townships 16 to 20 and Ranges 3 to 4 (Figure 9). The extent of large aspen tortrix defoliation was estimated to be 2653 ha. Defoliation was severe over 1884 ha (71%), moderate over 469 ha (18%), and light over 300 ha (11%).

In addition, some large areas defoliated by a combination of the large aspen tortrix and the forest tent caterpillar were observed in the Brazeau and Clearwater forest areas in the PBP Region (Figure 8). The total defoliated area was estimated at 106 853 ha. An estimated 83 905 ha (79%) of this defoliation were severe, 16 041 ha (15%) were moderate, and 6907 ha (6%) were light. In the Brazeau Forest Area, this defoliation was found in two relatively large areas within the Townships of 43 to 45 and Ranges 6 to 8. There were also a number of scattered small patches of defoliation in this forest area. In the Clearwater Forest Area, large areas of defoliation were observed in Townships 40 to 43 and Ranges 4 to 5. There were some scattered patches of defoliation as well.

No large aspen tortrix defoliation was reported in 2001 from the NEB Region.

FOREST TENT CATERPILLAR, *MALACOSOMA DISSTRIA* HÜBNER

The forest tent caterpillar defoliation in Alberta in 2001 was overshadowed by the concurrent large aspen tortrix defoliation. Consequently, the extent and severity of the forest tent caterpillar defoliation was not estimated this year.

In the NWB Region, large congregations of the forest tent caterpillar larvae were observed in areas west of Valleyview and along Highway 40 south of Grande Prairie. However, their defoliation was indistinguishable from the predominant large aspen tortrix defoliation that occurred in these areas. This was also true for the NES Region. In some areas of the PBP Region, forest tent caterpillar and the large aspen tortrix occurred in roughly equal proportions. This combination defoliated 6907 ha lightly, 16 041 ha moderately and 83 905 ha severely (Figure 8).

BRUCE SPANWORM, *OPEROPHTERA BRUCEATA* (HULST.)

Historically, severe defoliation of aspen forest by Bruce spanworm populations occur about once a decade and last 2 to 3 years. Invariably, these populations are either preceded or followed by the occurrence of other aspen defoliators (Hiratsuka *et al.* 1995). In keeping with these historical trends, the Bruce spanworm populations in Alberta collapsed in 2001 after causing 2 to 3 years of severe defoliation (Table 3).

SATIN MOTH, *LEUCOMA SALICIS* (LINNAEUS)

In Edmonton, the gradual decline of satin moth populations observed in 2000 continued in 2001. The satin moth populations crashed over most of its range in the city, with the notable exception of south-central Edmonton. This year, the cocoons of an introduced parasitoid wasp, *Cotesia melanoscelus*, were observed in increasing numbers on satin moth-infested trees in the city. These parasitoids may have contributed to the satin moth population decline observed in 2001.

GYPSY MOTH, *LYMANTRIA DISPAR* (LINNAEUS)

The Land and Forest Division of Alberta Sustainable Resource Development set up 49 Disparlure®-baited Delta traps in 2001 as part of the annual gypsy moth survey conducted by the Canadian Food Inspection Agency (CFIA). No gypsy moths were collected in these 49 traps that were deployed throughout the Green Area of the province.

BIRCH LEAFMINERS, *PROFENUSA THOMSONI* (KONOW) AND *FENUSA PUSILLA* (LEPELETIER)

The introduced ichneumonid wasp (*Lathrolestes nigricollis)*, a parasitoid of the birch leafminer, *F. pusilla,* spread rapidly within the city providing effective biological control of this leafminer sp. Another introduced ichneumonid wasp (*L. luteolator)* is credited with controlling the amber-marked birch leafminer, *Profenusa thomsoni,* outbreak in the city. As well, *L. luteolator* is now known to be widespread across the province.

SMALLER EUROPEAN ELM BARK BEETLE, *SCOLYTUS MULTISTRIATUS* (MARSHAM)

The smaller European elm bark beetle (SEEBB), a vector of Dutch elm disease, has been found recurrently in Calgary since 1994; in Edmonton since 1995; and in Medicine Hat since 1998. This beetle has been trapped in the past near Balzac, in Coutts, High River, Killam, Lloydminster, Red Deer, St. Albert, Strathcona County, and in Vauxhall.

In 2001, the Society to Prevent Dutch Elm Disease (STOPDED) monitored municipalities, provincial or municipal parks, plant nurseries, and all of the ports-of-entry at Alberta–Montana border for SEEBB. This year, 477 pheromone-baited sticky traps (Phero Tech Inc., B.C.) were set up at the above locations. The SEEBB was trapped this year—albeit in relatively lower numbers compared to the previous years—in Calgary (32), Edmonton (3), Lethbridge (2), Lloydminster (1), Taber (1) and for the first time in Wetaskiwin (17). The trap catches over the years suggest the presence of endemic SEEBB populations in Alberta. However, there is still no conclusive evidence of their establishment, i.e., SEEBB galleries with live beetle larvae in elm in Alberta.

The other vector species of DED—native elm bark beetle, *Hylurgopinus rufipes* Eichhoff—has not been trapped to date in Alberta.

DUTCH ELM DISEASE (DED), *OPHIOSTOMA ULMI* (BUIS.) NANNF.

The STOPDED provides education and public awareness of this disease. This society also has a program to confiscate any elm wood encountered at the ports-of-entry to Alberta from Montana and Saskatchewan.

In spite of having a relatively large American elm population, Alberta still remains free of Dutch elm disease (DED). To date the only confirmed record of DED in Alberta was from samples collected in 1998 from an elm tree in Wainwright; this tree was cut and burned. No new cases of the disease since have been reported in Alberta.

The STOPDED has produced an educational kit with the help of Alberta Agriculture Initiatives Program. This kit provides teachers with ready-made activities that meet the requirements of the

grades four and six curricula. It also includes a DED poster and a 15 minute educational video. The society also organized a DED Public Awareness Week during the week of May 28–June 1, 2001.

Further information on the DED program in Alberta can be found at the Internet website: http://www.agric.gov.ab.ca/ded

OTHER NOTEWORTHY PESTS

Dothiorella Wilt of Elm, *Dothiorella ulmi* Verall & May

Since 1996, a vascular wilt disease caused by the fungus, *Dothiorella ulmi*, has affected American elm trees in Edmonton. This disease results in progressive die back and eventual tree mortality. In 2001, another 16 elms with wilt symptoms were observed in the city; six of these were confirmed to have the disease. Together with the 41 confirmed cases in Edmonton in 2000, this disease has affected 140 elms in the city since 1996. Areas with high elm density appear to be more prone to this disease. Radical pruning of affected branches as well as nearby healthy -looking branches at early stages of the disease, appears to be effective in controlling it. Once the disease symptoms are well established and are closer to the main stem, pruning has no effect. Dr. J. P. Tewari of the University of Alberta, in collaboration with Chris Saunders of the City of Edmonton, is testing the effectiveness of the systemic fungicide, Alamo® (propiconazole) in controlling this disease.

Ink Spot Disease of Aspen, *Ciborinia whetzelli* (Seaver) Seaver

Aspen defoliation due to a leaf disease was spotted in the Porcupine Hills during the aerial surveys carried out in the PBP Region in 2001. Ground truthing indicated the ink spot disease caused this defoliation. This is a fungal disease caused by the pathogen, *Ciborinia whetzelii* (Seaver) Seaver. The defoliation was light over 756 ha, moderate over 129 ha and severe over 691 ha.

Red Elm Weevil, *Magdalis armicollis* (Say)

The red elm weevil, *Magdalis armicollis* (Say), damage was reported on elm in Lethbridge and surrounding areas.

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Rohwer)

There was a dramatic increase in the spread of yellowheaded spruce sawfly, *Pikonema alaskensis* (Rohwer), defoliation in Cypress Hills Provincial Park. However, the busy forest fire season interfered with taking effective action to control this pest in the park.

Root Collar Weevil, *Hylobius warreni* Wood

In 2001, there was an expansion of Warren root collar weevil, *Hylobius warreni* Wood, damage to naturally regenerating pine in Cypress Hills Provincial Park.

Disorders

In the PBP Region, several patches of flood-killed trees and lightning-killed trees were found scattered throughout the region during the aerial surveys carried out in the summer of 2001. Three patches of lightning-killed trees were found west of Hinton in the NES Region.

INVASIVE EXOTIC PLANTS (WEEDS)

PROVINCIAL

The Forest Health Program is responsible for managing invasive exotic plant species (noxious and restricted weeds) in the Green Area of the province. These plant species deem to pose a threat to the natural ecosystems of the province.

The provincial strategy has been to manage invasive exotic plants at a landscape level in conjunction with relevant stakeholders and other government agencies. This resulted in the establishment of several forest area-based co-operative weed management groups in 2001. The intent of these groups is to have joint initiatives that efficiently and effectively survey, control and promote awareness of invasive exotic plants. The regional and forest area staff are instrumental in the continuing establishment of these groups in the Green Area of the province.

REGIONAL

NORTHERN EAST SLOPES REGION

The main thrust of the 2001 invasive exotic plant program in the NES Region was to increase awareness and to implement control programs. A few invasive exotic plant inventories were conducted during the year although this was not one of the main objectives of the program.

Many invasive exotic plant control areas in this region are found in the provincial parks and recreation areas. In 2001, the management of provincial parks and recreation areas was transferred to The Department of Community Development. However, the invasive exotic plant control programs in these areas in 2001 were funded under Alberta Sustainable Resource Development; this responsibility will be handed over to Community Development in 2002.

Education and Awareness

No formal invasive exotic plant workshops were held in the region in 2001. However, several individual sessions on this topic were held for the benefit of different companies. In addition, posters and pamphlets on invasive exotic plants were distributed to various organizations and the general public.

The Woodlands Forest Area was instrumental in compiling a newspaper article on invasive exotic plants. This article was published in the following newspapers: *Edson Leader, Hinton Parklander, Fox Creek Times* and *Mayerthrope Freelancer.*

The Woodlands Forest Area is in the process of developing an invasive exotic plant co-operative. As an initial step, a database was created. This database contains the names of the companies with interest in this venture, their invasive exotic plant control contacts, telephone numbers and addresses. Contacts will be made in the winter to formulate an invasive exotic plant program for 2002.

Control

A herbicide, Transline®, was sprayed to control invasive exotic plants at eight sites within the Woodlands Forest Area. The total area treated with this herbicide was 33.2 ha. This herbicide was selected because it is not toxic to forest tree species. In this forest area, Canada thistle (*Cirsium arvense* L.) was manually controlled at another two sites. Manual control was preferred at these two sites because of their close proximity to water bodies. The Whitecourt Junior Forest Rangers assisted with this project.

In 2001, invasive exotic plants were controlled at 34 Crown sites in the Foothills and Yellowhead forest areas. The Junior Forest Rangers manually controlled invasive exotic plants at environmentally sensitive sites; herbicides were used to control invasive exotic plants at the other sites. The total area involved in this program was 42.25 ha. Nine of these sites were located within the multi-stakeholder invasive exotic plant control program area. This is the second year of operation of the multi-stakeholder invasive exotic plant control program in the Foothills and Yellowhead forest areas.

Alberta Sustainable Resource Development, Municipal District (MD) of Yellowhead and Canadian National Railway (CN) co-operated in controlling invasive exotic plant infestations at Swan Landing near Brule in the Foothills Forest Area. A large patch of Canada thistle (*Cirsium arvense* L.) at this location was effectively controlled by spraying. A three-year program will be developed with CN to control the remaining invasive exotic plant infestations at this site.

In 2001, a perennial infestation of the spotted knapweed (*Centaurea maculosa* Lam.) at a CN site in Hinton spread beyond the railway tracks. This site was sprayed again. One new spotted knapweed infestation was discovered this year along the highway to Brule. The invasive exotic plants at this site were picked and sprayed by the MD staff.

PARKLAND BOW, PRAIRIE REGION

In 2001, the most common invasive exotic plant species in this region were tall buttercup (*Ranunculus acris* L.); ox-eye daisy (*Chrysanthemum leucanthemum* L.); scentless chamomile (*Matricaria perforata* L.); Canada thistle (*Cirsium arvense* L.); and blueweed (*Echium vulgare* L.). The main focus of the program was to manage the invasive exotic plant species. No formal weed inventories were conducted in this region in 2001.

Control

In the Clearwater Forest Area, Alberta Sustainable Resource Development (SRD), disposition holders, grazing lease holders, the municipal districts and pipeline companies co-operated to manage invasive exotic plants. In the Bow Forest Area, Land and Forest Division (LFD) funded the Natural Resource Division (NRD) to control invasive exotic plants in the priority areas identified in their surveys. In the Crowsnest Forest Area, control efforts concentrated on new infestations, and a "contain and control" approach was taken where infestations are established. In this area, SRD, disposition holders, the municipal districts and oil companies co-operated to proactively manage invasive exotic plants at the landscape level. In the Brazeau Forest Area, a spray program was initiated to manage the invasive exotic plants in the high priority areas identified in 2000. In this forest area, partnerships with local industries are being developed to manage the invasive exotic plants.

NORTHWEST BOREAL REGION

Inventory and Control

The Wapiti River invasive exotic plant project has been ongoing since 1998. This year, a section of the river from the B.C. border to Township 71, Range 3 (West of sixth Meridian) was targeted for control. The staff in the Wapiti Forest Area, in collaboration with the staff from the Grande Prairie No. 1 County and Public Lands Division, either hand-picked or sprayed invasive exotic plants along the Wapiti River. These invasive exotic plant species included scentless chamomile, common tansy, toadflax, perennial sow thistle, and Canada thistle. In this forest area, herbicidal sprays were used to control Canada thistle on a vacant Crown land along the Canyon Creek; scentless chamomile at a public gravel pit; and common tansy at the Two Lakes Fire Base.

An ox-eye daisy infestation was found on a private land during the inventory surveys carried out in this forest area.

The Mackenzie Forest Area worked in co-operation with the MD of Northern Lights and Clear Hills in their invasive exotic plant program. Under this program, either spraying and/or handpicking was used to control scentless chamomile in the areas of Chinchaga, Clear Hills, Notikewin and Haro Oilfield. Some invasive exotic plant inventory work was also carried out under this co-operative program.

The Marten Hills and Lakeshore forest areas implemented a joint invasive exotic plant management program in 2001. Inspections by a summer weed technician showed that an estimated 62% of the sites in the Nipisi/Utikima oilfield area had weed infestations. Only 2% of the inspected sites in the Wabasca Oilfield area were infested. In 2001, Escort ® was sprayed to control common tansy in Township 71, Range 4 (West of the fifth Meridian) in the Marten Hills Forest Area. Because the results of this spray were poor, the contractor will spray this area again in 2002.

The East Peace Forest Area and the MD of East Peace co-operated in their invasive exotic plant management programs. They inventoried invasive exotic plants at 73 sites. Scentless chamomile was handpicked at two sites in this forest area.

NORTHEAST BOREAL REGION

In 2001, the NEB Region adopted an invasive exotic plant strategy developed by the FHO. This invasive exotic plant strategy focussed on several goals: enhancing consistency in delivery of the regional program; co-ordinating regional management efforts among the LFD and industry stakeholders; addressing invasive exotic plant issues at the landscape level (rather than by the dispositions); and cohesive and comprehensive management planning for the whole region. The following strategic objectives were identified to achieve these goals in 2001: prioritizing survey areas; conducting surveys; and establishing a Co-operative Invasive Exotic Plant Management Group.

Prioritizing Survey Areas

The regional land managers' (land use, resource and protection) input was sought to identify areas to focus on during the invasive exotic plant surveys. Inventorying invasive exotic plants was expanded in 2001 to include areas under the Forest Act and vacant Crown land not currently under dispositions. Priority was given to following-up areas inventoried during the surveys carried out in previous years.

Invasive Exotic Plant Surveys

In the NEB Region, 614 surveys were carried out in 2001. The Land and Forest Division (LFD) of SRD carried out 484 of these surveys and the stakeholders submitted data from 130 surveys. Invasive exotic plant infestations were observed on 41% of the 484 sites surveyed by the LFD. The inventoried sites composed of land use dispositions (44%); timber dispositions and cutblocks not under dispositions (40%); and other sites including the public facilities (16%). The land use disposition sites had the highest percentage infested (64.40%) followed by the other sites that had 20.74% infested and the timber dispositions with 14.86% of the sites infested. The severity of infestation was trace in 15%, low in 38%, moderate in 33% and high in 14% of the infested sites[2]. The cutblocks had trace, low or moderate infestations. Most of the infestations in the cutblocks were concentrated at the access points. None of the infestations in the cutblocks exceeded one hectare in extent.

The frequency of occurrence of the invasive exotic plant species encountered in the surveys is given below:

Common Name	Scientific Name	Frequency (%)
Scentless chamomile	*Matricaria perforata* L.	62%
Common thistle	*Tanacetum vulgare* L.	12%
Perennial sow-thistle	*Sonchus arvensis* L.	11%
Canada thistle	*Cirsium arvense* L.	5%
Ox-eye daisy	*Chrysanthemum leucanthemum* L.	4%
Tall buttercup	*Rananculus acris* L.	2%
Toadflax	*Linaria vulgaris* Mill.	1%
Other spp.		3%

During 2001, no restricted invasive exotic plants were found during the surveys carried out by SRD. However, one stakeholder reported finding nodding thistle (*Carduus nutans* L.) during a survey.

Co-operative Invasive Exotic Plant Management Groups

In 2001, 60 out of 124 stakeholders invited, attended the two regional Co-operative Invasive Exotic Plant Management Group meetings. This group has defined its purpose, developed the terms of reference, and promoted development of invasive exotic plant plans consistent with the regional objectives.

---

[2] The following categories, as outlined in the Land and Forest Division Weed Survey Information Sheet, were used to assess the severity of invasive exotic plant infestations: (Trace (Rare) <1% cover; Low (Occasional) ≥1% to <5% cover; Moderate (Scattered) ≥5% to <25% cover; High (Fairly dense) ≥25% cover.

INCREASED AWARENESS AND TRAINING

PROVINCIAL

INCREASED AWARENESS

Posters and Pamphlets

This year, the Forest Health Centre produced and distributed a poster on mountain pine beetle to increase the awareness about this looming pest. This poster with short descriptions and colour illustrations depicting the signs and symptoms of the pest is available free of charge for distribution. Please contact either Mike Undershultz of the Forest Health Centre at (780) 427-8474 or visit our website. This poster is also available at:

Alberta Environment Information Centre
Main Floor, Great West Life Building
9920 – 108 Street
Edmonton, AB
T5K 2M4
Telephone (780) 422-2079

Activity Book

The Forest Health Centre, in collaboration with the Public Education and Outreach Branch produced an activity book entitled "Envirokids Investigate Alberta's Forests: Forest Health." Although the target group for this book are students in grade 6, this book may also be used for grades 7-8. This activity book introduces children to basic forest ecosystem concepts and the economic, environmental, and social values of the forest. The health and management of the forest are presented as complex but integrated processes. Fire, forest insects and diseases are introduced as being natural phenomena that might become devastating if they run out of control. The threat of exotic species to Alberta's forests is discussed. This activity book also helps children categorize tree species, and insect, animal and disease damage. This book is available for distribution at the Information Centre (please see above for details) or available online at our website.

North American Forest Insect Work Conference

Alberta Sustainable Resource Development, Canadian Forest Service and the University of Alberta were instrumental in organizing an international conference on forest insects. This conference entitled "North American Forest Insect Work Conference" (NAFIWC) was held from May 14 to 18, 2001, at the Crown Plaza Hotel in Edmonton. The conference was well attended by nearly 300 national and international delegates. The NAFIWC proceedings from the two plenary sessions, three concurrent panel discussions and 150 workshop presentations have been published.

Provincial Integrated Pest Management Committee

The fifth annual meeting of the Provincial Integrated Pest Management (IPM) Committee was held on October 10, 2001, at the Great West Life Building in Edmonton. This meeting was attended by representatives from SRD, regional IPM groups, Canadian Forest Service, University of Alberta, Alberta Forest Products Association, The City of Edmonton, forest industry and the Forest Nursery Association. The mandate of this group was changed from a "committee" to a "meeting" in view of them discussing forest health-related matters but not voting on any resolutions. Henceforth this will be known as the "Annual Meeting of the Provincial Integrated Pest Management Group."

TRAINING

Invasive Exotic Plants

This year, the Forest Health Centre collaborated with several other governmental and non-governmental organizations to organize a workshop on invasive exotic plants. The objective of this workshop was to increase awareness about these plants and their management. For details about this workshop entitled "Weed Awareness for Reclamation (WAR)" please visit the website:

http://www3.gov.ab.ca/protenf/landrec/documents/WeedAwarenessforReclamation.pdf

Mike Undershultz (Forest Health Officer) at the Forest Health Centre was a co-trainer of a weed identification workshop held in the Northeast Boreal Region.

REGIONAL

INCREASED AWARENESS AND TRAINING

Parkland Bow, Prairie Region

In 2001, PBP Regional Forest Health Officer held several sessions to train the forest fire fighters, forest industry staff and some contractors on identifying the mountain pine beetle-attacked trees. He also trained the Bow Forest Area and Spray Lake Sawmills staff on dwarf mistletoe survey methodology.

Northwest Boreal Region

Increased awareness and knowledge of priority pest species were promoted by several forest health workshops held within the region. These included a regional forest health workshop held in May for forest industry and government staff by the Canadian Forest Service staff and the Regional Forest Health Officer; a workshop held by the Regional Forest Health Officer in August for Weyerhaeuser (Slave Lake) staff; and another workshop held by the regional FHO for the benefit of individuals involved in formulating the detailed forest management plan for Tolko- High Level and Footner Forest Products. A Spruce Budworm Decision Support (DSS) System workshop was held for the government and Tolko-High Level staff. This DSS workshop was held by the staff from the Canadian Forest Service, Fredericton.

Northern East Slopes Region

The Regional Forest Health Officer held several training sessions on invasive exotic plants for the benefit of individual companies. Related literature was distributed to increase the invasive exotic plant awareness of the organizations and the general public.

REGIONAL IPM WORKING GROUPS

Northeast Boreal Region

This working group met three times in 2001. The group has established its terms of reference. This group is working towards integrating the forest health management with overall forest management.

Northwest Boreal Region

Five IPM Working Group members [Alberta Sustainable Resource Development and four forest companies, viz., Alberta Plywood, Buchanan Lumber, Canadian Forest Products (Grande Prairie) and Daishowa Marubeni International] participated in a pilot project to assess the forest health monitoring system developed by the Canadian Forest Service. The purpose of this project was to determine the time and resources needed to implement the system annually; to identify problems with the methodologies and ways to improve them; and to determine the value of the data collected. Five broad survey types (regeneration surveys, permanent sample plot visitations, aerial detection surveys, ground-truthing surveys and subterranean surveys) were conducted to collect information on 12 different forest insect and disease pests. The results of this pilot project will be used to improve this monitoring system before it will be implemented in 2002.

RESEARCH AND DEVELOPMENT

FIELD TRIALS

FOREST TENT CATERPILLAR PHEROMONE STUDY

In the NWB Region, Uni-traps® baited with a new formulation of forest tent caterpillar pheromone (Phero Tech Inc., B.C.) were used to monitor the forest tent caterpillar moth populations. These traps were deployed in stands that had light, moderate or severe defoliation in 2000. The average eggmass count in relation to the diameter at breast height (dbh) of the tree was also recorded from each test plot. However, the forest tent caterpillar defoliation could not be recorded in 2001 because it was overshadowed by defoliation due to the large aspen tortrix.

FIELD TESTING OF SATIN MOTH PHEROMONE

The satin moth is a potential threat to aspen stands in the Green Area of the province. Dr. Gerhard Gries of Simon Fraser University in British Columbia first isolated the satin moth sex pheromone known as Leucomalure. In 2000, Dr. Gries formulated this pheromone for commercial production in a project partly funded by Alberta Sustainable Resource Development.

In 2001, Chris Saunders of the City of Edmonton field-tested the formulated pheromone produced by Phero Tech Inc. (B.C.). Thirty pheromone-baited traps were deployed in south-central Edmonton at 10 sites with current satin moth populations. Similar traps, each baited with two virgin females, were used as checks for comparison. The moth catches in the pheromone-baited traps were comparable to those in the traps baited with two virgin females.

BIOLOGICAL CONTROL OF SATIN MOTH

In 2001, Chris Saunders of the City of Edmonton studied the incidence of two satin moth parasitoids, *Cotesia melanoscelus* and *Meteorus versicolor* at Corbett Lake, B.C. The objective of this project was to find the relative roles of these two parasitoids in satin moth control. This project was funded by an Alberta-Pacific Forest Industries Inc. (Alpac) grant for forest research. At this site, up to 70% of satin moth larvae were killed by *Cotesia melanoscelus;* in comparison only about 1% of the satin moth larvae were killed by *Meteorus versicolor.* Moreover, *M. versicolor* appears to have a broader range of hosts making it less desirable as a biological control agent. In view of these results, the plans to introduce *M. versicolor* to augment biological control of satin moth in Edmonton are being reconsidered.

MONITORING SPREAD OF ARMILLARIA ROOT DISEASE

The Forest Health Officer of the PBP Region initiated a field study in 2001 to monitor the spread of Armillaria root disease in a selectively logged area near Nordegg. Transects (100 m by 10 m) originating from the known root disease centres were established. These will be used to monitor the progress of the disease through the remainder of the stand.

ESTIMATING STAND LEVEL SEVERITY OF LODGEPOLE PINE DWARF MISTLETOE

The technique for severity rating of lodgepole pine dwarf mistletoe (*Arceuthobium americanum* Nutt. Ex. Engelm.) at the tree level is widely known. However, a standard technique to determine the stand level severity of this disease has not been available. The Forest Health Officer in the PBP Region tested several plot sizes in a mistletoe-infested stand to find a suitable plot size to estimate the disease severity at the stand level. He tested another mistletoe-infested stand to find the number of plots needed for mistletoe severity rating in relation to the extent of the stand. Comparison of ratings obtained by using different sized plots indicated that a circular plot with a diameter of 5.64 m provided the best method of rating for dwarf mistletoe severity at the stand level. The results from the second test stand showed that a minimum of three plots are needed for rating mistletoe severity in a stand up to 10 ha; an additional plot is needed for every five ha increment of the stand size.

BIOLOGICAL CONTROL OF SCENTLESS CHAMOMILE

The scentless chamomile gall midge, *Rhopalomyia* sp. and the seed pod weevil, *Omphalapion hookeri* are native to Europe and feed exclusively on scentless chamomile. Alberta Research Council in Vegreville imported and field-tested these two insect species for biological control of scentless chamomile.

In 2001, the Forest Health Officer of the NES Region introduced the seed pod weevil at two sites and the gall midge at another two sites infested with scentless chamomile. Grasshoppers destroyed one site with the gall midge and the other site was inadvertently sprayed with a herbicide. On the contrary, the weevils got established well at their two sites. These sites will be monitored to find the overwinter survival of the seed pod weevils under field conditions.

IMPACT OF UNGULATE BROWSING

Ungulate browsing is a concern in the PBP Region where some browsed trees may not be acceptable under the regeneration standards. In view of this, the Regional Forest Health Officer launched a long-term field trial to study the impact of ungulate browsing on regenerating stands. The objective is to find the impact of single-year vs. multi-year browsing on the height growth, diameter at breast height (dbh) and form of pines at five-years, 10-years and 20-years after browsing.

In this study, ungulate browsing will be simulated by clipping the terminal or dominant shoots of pines planted within an enclosed area inaccessible to wildlife. The terminal or dominant shoot will be clipped after one-year, two-years, and three-years.

DEVELOPMENT

CD-ROM FOR DIAGNOSING FOREST PEST DAMAGE

The database for the CD has been built and most of the images of pest damage have been digitized. This CD is still in its "alpha version", i.e., early testing stage, due to some unexpected technical problems encountered.

REFERENCES

Feddes-Calpas, J., 2001. Alberta's Dutch elm disease prevention program report for 2001. Unpublished report. Alberta Agriculture, Food and Rural Development, Edmonton, AB.

Gries, G., 2000. Progress Report (3): Development of a commercial pheromone lure for detection of exotic satin moth, *Leucoma salicis*,, populations in Alberta. Unpublished Report, Simon Fraser University, Department of Biological Sciences, 8888 University Drive, Burnaby, B.C.

Hiratsuka, Y., Langor, D.W., and Crane, P.E., 1995. A field guide to forest insects and diseases of the prairie provinces. Nat. Resour. Can. For. Serv., Northwest Reg., North. For. Cent., Edmonton, Alberta, Spec. Rep. 3.

Ives, W.G.H., and Wong, H.R. 1988. Tree and shrub insects of the prairie provinces. Can. For. Serv., Nor. For. Cent., Edmonton, Alberta. Int. Rep. NOR-X-292.

Kominek, C., 1999. Mountain pine beetle management guide: A revisable manual. Alberta Environment, Forest Health Branch, Edmonton, AB.

Pengelley, I., Fire/Vegetation Specialist, Banff National Park, Banff, AB.

Ranasinghe, S.K. and Kominek, C., 1998. Spruce budworm management guide. A revisable manual. Alberta Environmental Protection, Forest Health Branch, Edmonton, AB.

Ranasinghe, S.K., and Kominek, C., 1999. Forest health aerial survey manual. A revisable manual. Alberta Environment, Forest Health Branch, Edmonton, AB.

Safranyik, Les, 2000. Outbreak origins: Development of an outbreak. Mountain Pine Beetle Science Showcase, Cranbrook, BC, April 11, 2000.

Saunders, Christopher, 2001. Urban forest insect and disease report. Unpublished report. Community Services, City of Edmonton, AB.

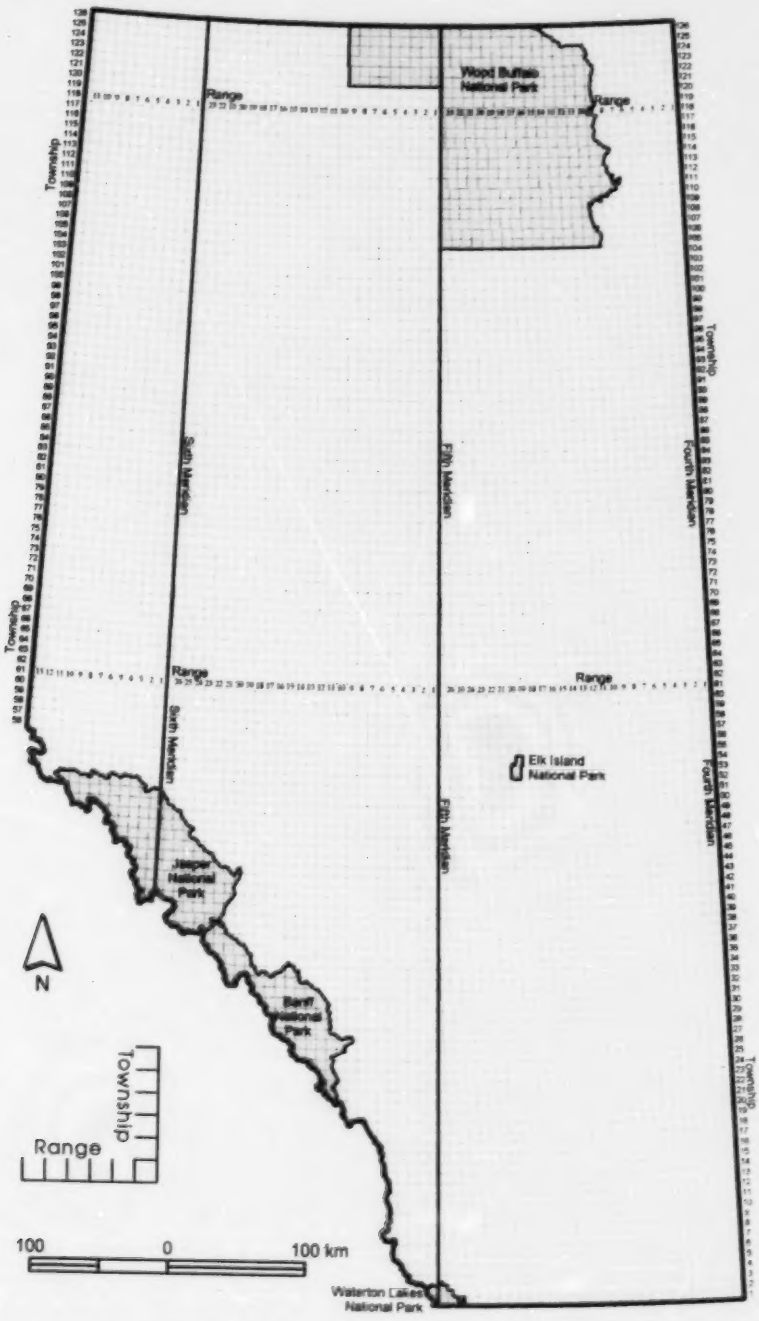
Unger, L.S., 2001. Forest health network forest conditions: Jasper National Park 2001. Unpublished report. Nat. Resour. Can. For. Serv., Pacific For. Cent., Victoria, B.C.

Westhaver, Alan., Vegetation and Fire Specialist, Jasper National Park, Jasper, AB.

APPENDIXES

APPENDIX I

ALBERTA TOWNSHIP SYSTEM



Appendix 1. Alberta Township System.

APPENDIX II

INFORMATION ON OPERATIONAL USE OF PHEROMONES IN ALBERTA, 2001

FOREST TENT CATERPILLAR

Chemical component(s):	Z5, E7 - dodecadienal
Lure type:	Flexlure®
Trap type:	Uni-trap®
Pheromone source:	Phero Tech Inc., Delta, British Columbia

GYPSY MOTH

Chemical component(s):	(+)cis-7, 8-epoxy-2-methyloctadecane (Disparlure®)
Lure type:	laminated strip
Trap:	Delta sticky trap
Pheromone source:	Trécé Inc., Salinas, California (purchased and distributed by Canadian Food Inspection Agency)

MOUNTAIN PINE BEETLE

Chemical component(s):	trans-verbenol, exo-brevicomin
Lure type:	pre-packed tree-bait
Trap:	not applicable
Pheromone source:	Phero Tech Inc., Delta, British Columbia

SATIN MOTH

Chemical component	3Z-cis-6,7 –cis-9,10-diepoxyheneicosene
Lure type	Flexlure®
Trap	Delta sticky trap
Pheromone source:	Phero Tech Inc., Delta, British Columbia

SPRUCE BUDWORM

Chemical component(s):	95% E-11-tetradecenal, 5% Z-11-tetradecenal
Lure type:	Biolure®
Trap type:	Multi-Pher I®
Pheromone source:	Consep Inc. (purchased and distributed by Dr. Chris Sanders, Natural Resources Canada, Sault Ste Marie, Ontario)